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A.D. 1872, 25th APRIL. N<sup>o</sup> 1243.

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SPECIFICATION

OF

SIDNEY WILLIAM RICH.

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MANUFACTURE OF SULPHATES.

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LONDON:

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A.D. 1872, 25th APRIL. N° 1243.

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### Manufacture of Sulphates.

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**LETTERS PATENT** to Sidney William Rich, of Chenies Street, in the County of Middlesex, Analytical Chemist, for the Invention of "IMPROVEMENTS IN THE MANUFACTURE OF SULPHATES."

Sealed the 8th October 1872, and dated the 25th April 1872.

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**PROVISIONAL SPECIFICATION** left by the said Sidney William Rich at the Office of the Commissioners of Patents, with his Petition, on the 25th April 1872.

I, SIDNEY WILLIAM RICH, of Chenies Street, in the County of Middlesex, Analytical Chemist, do hereby declare the nature of the said Invention for "IMPROVEMENTS IN THE MANUFACTURE OF SULPHATES," to be as follows :—

This Invention relates to the conversion of the peroxide of iron and alumina in burnt or waste shale or other similar material into sulphates.

The object is effected by bringing the moist material into contact in suitable vessels with sulphurous acid, by the reaction which ensues between the sulphurous acid and the peroxide of iron sulphuric acid.



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*Rich's Improvements in the Manufacture of Sulphates.*

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and protoxide of iron are produced; these unite at the moment of their production giving rise to protosulphate of iron which is in part or wholly decomposed by the alumina, forming a greater or less quantity of sulphate of alumina and free protoxide of iron. The sulphate of alumina and the remaining sulphate of iron may then be dissolved out 5 by means of water and the solution evaporated, or its constituents recovered in any suitable manner.

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**SPECIFICATION** in pursuance of the conditions of the Letters Patent, filed by the said Sidney William Rich in the Great Seal Patent Office on the 25th October 1872. 10

**TO ALL TO WHOM THESE PRESENTS SHALL COME, I, SIDNEY WILLIAM RICH,** of Chenies Street, in the County of Middlesex, Analytical Chemist, send greeting.

**WHEREAS** Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Twenty-fifth day of April, in the year of 15 our Lord One thousand eight hundred and seventy-two, in the thirty-fifth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Sidney William Rich, Her special licence that I, the said Sidney William Rich, my executors, administrators, and assigns, or such others as I, the said Sidney William Rich, my executors, 20 administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for “**IMPROVEMENTS IN THE 25 MANUFACTURE OF SULPHATES,**” upon the condition (amongst others) that I, the said Sidney William Rich, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and 30 cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

**NOW KNOW YE,** that I, the said Sidney William Rich, do hereby declare the nature of my said Invention, and in what manner the 35



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*Rich's Improvements in the Manufacture of Sulphates.*

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same is to be performed, to be particularly described and ascertained in and by the following statement thereof, that is to say :—

This Invention relates to the conversion of the peroxide of iron and alumina in burnt or waste shale or other similar material into  
5 sulphates.

The object is effected by bringing the moist material into contact in suitable vessels with sulphurous acid, by the reaction which ensues between the sulphurous acid and the peroxide of iron sulphuric acid and protoxide of iron are produced; these unite at the moment of their  
10 production giving rise to protosulphate of iron, which is in part or wholly decomposed by the alumina, forming a greater or less quantity of sulphate of alumina and free protoxide of iron. The sulphate of alumina and the remaining sulphate of iron may then be dissolved out by means of water and the solution evaporated or its constituents  
15 recovered in any suitable manner.

The material I prefer to use is the recently burnt shale or schist while still retaining the heat arising from its combustion, and while in this condition I bring it into contact with a current of sulphurous acid gas, air, and steam.

20 I prefer to effect my purpose in the following manner :—I cause the shale or schist to burn in and above a circular cell built of brick or stone, about twenty or twenty-five feet high, and ten feet in diameter inside. The walls of the cell should be about five feet thick at the top, so that the total diameter at the top shall be about twenty feet. These walls may  
25 be built of stone outside and brick inside and the space between the brick and stone filled with earth or other heavy rubbish. At the lower part of the cell are several openings about two feet in diameter, provided with doors for the removal of the contents of the cell. I find four such openings to be a suitable number for a cell having an inside diameter  
30 of ten feet.

I facilitate a proper combustion of the shale or schist by piling it above the cell in the form of a heap after the cell itself shall have been filled and by allowing the heap to cover the walls of the cell, this heap may be made to have a diameter at its base of about twenty feet. As  
35 the material is withdrawn from the openings at the lower part of the cell the heap gradually sinks into the cell when it must be kept up to its original size and the combustion maintained by the supply of fresh



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*Rich's Improvements in the Manufacture of Sulphates.*

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shale or schist from above. The combustion of the shale or schist having at the beginning been started by means of wood or coal may be maintained by this means without any further fuel while the material may be withdrawn at intervals from below. By thus withdrawing the material from below the contents of the cell are kept in a loose state, 5 and thus rendered more permeable to the sulphurous acid gas, air, and steam, the introduction of which I now proceed to describe. As the contents of the cell must be at a high temperature before my requirements can be fulfilled, I continue withdrawing material from the bottom and supplying fresh shale or schist to the top until the material with- 10 drawn is so hot as to hiss on the application of cold water, when this stage is reached I close the openings below and cause the introduction of a current of sulphurous acid gas, air, and steam. In order to prevent the fire at the top from burning itself out a coating of fresh schist or shale is laid on at intervals. The current of sulphurous acid gas is 15 produced by burning pyrites in furnaces or by other known means, and the gas is forced into the cell by means of a fan or fans working in the flue or flues which connect the sulphur furnaces with the cell; the current of sulphurous acid gas is forced into the lowermost portion of the cell, so that the gas may traverse the whole mass of material. 20

In addition to the current of sulphurous acid gas I cause the introduction at the lower part of the cell of a jet or jets of steam from a steam boiler, and the supply of steam is determined by the smell issuing from the upper part of the cell at the surface of the heap, if there is a strong smell of sulphurous acid gas more steam must be admitted, if 25 there is no smell, or only a slight smell of sulphurous acid gas, the supply of steam may be diminished or even as occasion demands quite stopped. I also cause the introduction of a current of atmospheric air at the lower part of the cell by means of a fan or fans drawing half the volume drawn by the fan or fans used for the sulphur 30 furnaces.

The result of the joint action of sulphurous acid gas, air, and steam on the hot burnt shale is the production of sulphate of alumina, containing a small proportion of sulphate of iron and also some sulphate of magnesia. This operation is continued until the persistent escape of 35 sulphurous acid gas from the surface of the heap shows that the contents have been fully acted upon, and when this occurs a portion of the contents may be periodically removed from the openings below, the



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*Rich's Improvements in the Manufacture of Sulphates.*

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supply of fresh shale being kept up from above. It is well to stop the admission of sulphurous acid gas while the doors are opened for the withdrawal of material.

In the event of an excess of steam being admitted a fluid solution is  
5 formed to some extent and sinks to the bottom of the cell; as this liquor is valuable the floor of the cell should be cemented and furnished with a drain so that the liquor may be run off and collected, indeed it is in some cases found useful to favour the formation of such a liquor. By the above process a continual action is kept up allowing the periodical  
10 removal of a portion of the salts formed. The substance removed may be dissolved in water in order to separate insoluble matters, and the solution obtained used for the manufacture of alum, sulphate of alumina, Epsom salts, and for other known processes. Simply evaporated to a solid consistence it forms an excellent material wherewith to treat sewage.

15 And having now described the nature of my said Invention, and in what manner the same is to be performed, I declare that I claim, treating burnt or waste schist or shale or other similar material with sulphurous acid gas in order to convert the bases contained in these substances into sulphates, substantially as described.

20 In witness whereof, I, the said Sidney William Rich, have hereunto set my hand and seal, this Twelfth day of October, in the year One thousand eight hundred and seventy-two.

SIDNEY W. RICH. (L.S.)

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LONDON :

Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,  
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